Formative Classroom Assessment and Benjamin S. Bloom:

Theory, Research, and Implications

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Abstract

Although much recent attention has focused on gaps in the achievement of different groups of students, the problem has been with us for decades. This paper presents the problem as one of reducing variation in students' achievement, and reviews the work of renowned educator Benjamin Bloom on this problem. Bloom argued that to *reduce* variation in students' achievement and to have all students learn well, we must *increase* variation in instructional approaches and learning time. The key element in this effort was well constructed, formative classroom assessments. Bloom outlined a specific strategy for using formative classroom assessments to guide teachers in differentiating their instruction and labeled it "mastery learning." This paper describes Bloom's work, presents the essential elements of mastery learning, explains common misinterpretations, and describes the results of research on its effects.

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Achievement gaps among different groups of students have concerned government and educational leaders for many years. In the 1960s, President Lyndon Johnson's "War on Poverty" focused directly on inequalities in the educational achievement of economically disadvantaged students and their more advantaged counterparts. The Economic Opportunity Act (EOA) of 1964, which established the Head Start program, and the Elementary and Secondary Education Act (ESEA) of 1965, which created the Title I and Follow Through programs, were specific attempts to address these gaps in educational attainment.

More recently, the *No Child Left Behind* (NCLB) legislation (U.S. Congress, 2001) revived these concerns. The law requires schools to report achievement results separately for various poverty, ethnicity, language, and disability subgroups. Not only must schools identify any achievement gaps among these different student subgroups, they also must take specific steps to close them.

Over the years educational researchers have learned a lot about reducing these achievement disparities. Yet because of our tendency in education today to focus only on "what's new," a lot of that important knowledge is being neglected. Instead of building on what we already know, many modern proposals for closing achievement gaps simply rename well-established principles, adding to the tangled thicket of terminology that confounds progress in education. To succeed in our efforts to close achievement gaps and to reach our goal of helping *all* students learn well, we need instead to recognize and extend this hard-earned knowledge base.

Researchers' Views

Researchers do their best to view problems in their simplest and most basic form. From a researcher's perspective, therefore, achievement gaps are simply matters of "variation": students vary in their levels of achievement. Some students learn excellently in school and reach high

levels of achievement, while others learn less well and attain only modest levels. Whenever we measure two or more students' achievement, we also measure this "variation."

Researchers design studies to "explain" variation. They make educated guesses, called "hypotheses," about what factors contribute to the differences among individuals. Then they manipulate those factors in carefully planned investigations to determine the effects. When they find a relationship between the factors that they manipulate and differences in outcomes, they succeed in their efforts to "explain" variation.

One of the early researchers concerned with explaining variation in student achievement was Benjamin S. Bloom. In the early 1960s, Bloom's studies focused on individual differences, especially in students' school learning. While he recognized that many factors outside of school affect student learning (Bloom, 1964), his investigations showed that teachers have potentially strong influence as well.

In his observations of classrooms, Bloom noted that most teachers included little variation in their instructional practices. The majority taught all students in much the same way and provided all with the same amount of time to learn. The few students for whom the instructional methods and time were ideal learned excellently. The largest number of students for whom the methods and time were only moderately appropriate learned less well. And students for whom the instruction and time were inappropriate due to differences in their backgrounds or learning styles, learned very little. In other words, little variation in the teaching resulted in great variation in student learning. Under these conditions the pattern of student achievement was similar to the normal curve distribution shown in Figure 1.

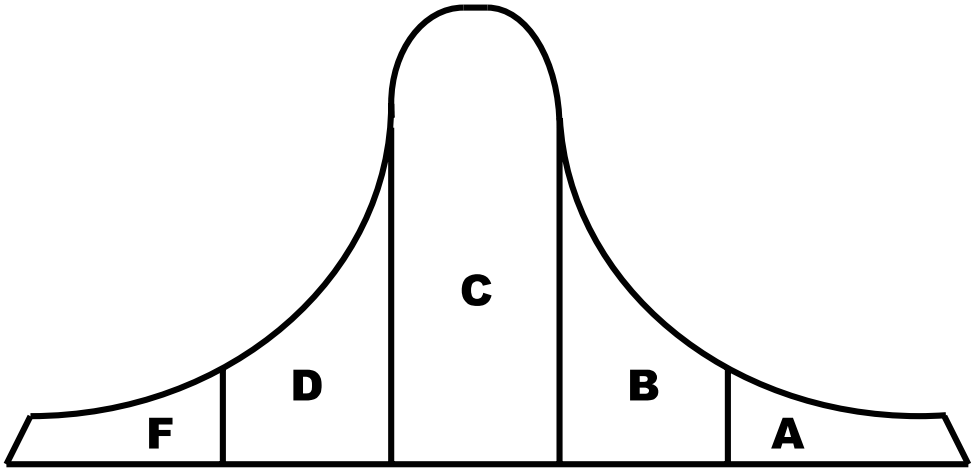

Figure 1. Distribution of Achievement in Traditional Classrooms

To attain better results and *reduce* this variation in student achievement, Bloom reasoned that we would have to *increase* variation in the teaching. That is, because students varied in their learning styles and aptitudes, we must diversify and differentiate instruction to better meet their individual learning needs. The challenge was to find practical ways to do this within the constraints of group-based classrooms so that *all* students learn well.

In searching for such a strategy, Bloom drew primarily from two sources of evidence. First he considered the ideal teaching and learning situation in which an excellent tutor is paired

with each student. He was particularly influenced by the work of early pioneers in individualized instruction, especially Washburne (1922) and his Winnetka Plan, and Morrison (1926) and his University of Chicago Laboratory School experiments. In examining this evidence, Bloom tried to determine what critical elements in one-to-one tutoring and individualized instruction could be transferred to group-based classroom settings.

Second, Bloom looked at studies of the learning strategies of academically successful students, especially the work of Dollard and Miller (1950). From this research he tried to identify the activities of high achieving students in group-based classrooms that distinguish them from their less successful classmates.

Bloom believed it was reasonable for teachers to organize the concepts and skills they wanted students to learn into instructional units. He also considered valuable for teachers to assess student learning at the end of each unit. But he found that most teachers' classroom assessments did little more than show for whom their initial instruction was and was not appropriate.

A far better approach, according to Bloom, would be for teachers to use their classroom assessments as learning tools, and then to follow those assessments with a *feedback and corrective* procedure. In other words, instead of using assessments only as evaluation devices that mark the end of each unit, Bloom recommended using them as part of the instructional process to *diagnose* individual learning difficulties (feedback) and to *prescribe* remediation procedures (correctives).

This is precisely what takes place when an excellent tutor works with an individual student. If the student makes an error, the tutor first points out the error (feedback), and then follows up with further explanation and clarification (correctives) to ensure the student's understanding. Similarly, academically successful students typically follow up the mistakes they make on quizzes and assessments. They ask the teacher about the items they missed, look up the answer in the textbook or other resources, or rework the problem or task so that errors are not repeated.

Bloom's Mastery Learning

Benjamin Bloom then outlined a specific instructional strategy to make use of this feedback and corrective procedure, labeling it "learning for mastery" (Bloom, 1968), and later shortening the name to simply "mastery learning" (Bloom, 1971). With this strategy, teachers first organize the concepts and skills they want students to learn into instructional units that typically involve about a week or two of instructional time. Following initial instruction on the unit, teachers administer a brief "formative" assessment based on the unit's learning goals. Instead of signifying the end of the unit, however, this formative assessment's purpose is to give students information, or feedback, on their learning. It helps students identify what they have learned well to that point and what they need to learn better (Bloom, Hastings, & Madaus, 1971).

Paired with each formative assessment are specific "corrective" activities for students to use in correcting their learning difficulties. Most teachers match these "correctives" to each item or set of prompts within the assessment so that students need work on only those concepts or skills not yet mastered. In other words, the correctives are "individualized." They may point out additional sources of information on a particular topic, such as page numbers in the textbook or workbook where the topic is discussed. They may identify alternative learning resources such as different textbooks, learning kits, alternative materials, CDs, videos, or computerized

instructional lessons. Or they may simply suggest sources of additional practice, such as study guides, independent or guided practice activities, or collaborative group activities.

With the feedback and corrective information gained from a formative assessment, each student has a detailed prescription of what more needs to be done to master the concepts or skills from the unit. This "just-in-time" correction prevents minor learning difficulties from accumulating and becoming major learning problems. It also gives teachers a practical means to vary and differentiate their instruction in order to better meet students' individual learning needs. As a result, many more students learn well, master the important learning goals in each unit, and gain the necessary prerequisites for success in subsequent units (Bloom, Madaus, & Hastings, 1981).

When students complete their corrective activities after a class period or two, Bloom recommended they take a *second* formative assessment. This second, "parallel" assessment covers the same concepts and skills as the first, but is composed of slightly different problems or questions, and serves two important purposes. First, it verifies whether or not the correctives were successful in helping students overcome their individual learning difficulties. Second, it offers students a second chance at success and, hence, has powerful motivational value.

Some students, of course, will perform well on the first assessment, demonstrating that they've mastered the unit concepts and skills. The teacher's initial instruction was highly appropriate for these students and they have no need of corrective work. To ensure their continued learning progress, Bloom recommended these students be provided with special "enrichment" or "extension" activities to broaden their learning experiences. Such activities often are self-selected by students and might involve special projects or reports, academic games, or a variety of complex, problem-solving tasks. Figure 2 illustrates this instructional sequence.

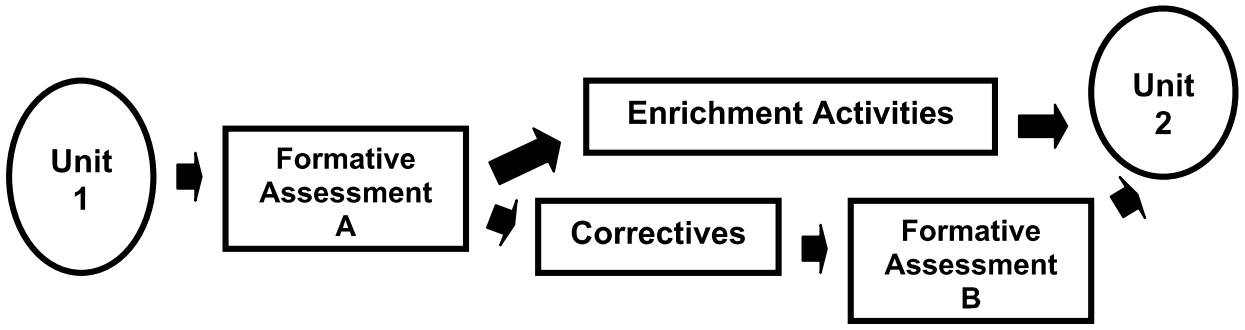

Figure 2. The Mastery Learning Instructional Process

Through this process of formative classroom assessment, combined with the systematic correction of individual learning difficulties, Bloom believed all students could be provided with a more appropriate quality of instruction than is possible under more traditional approaches to teaching. As a result, nearly all might be expected to learn well and truly master the unit concepts or learning goals (Bloom, 1976). This, in turn, would drastically reduce the variation in students' achievement levels, eliminate achievement gaps, and yield a distribution of achievement more like that shown in Figure 3.

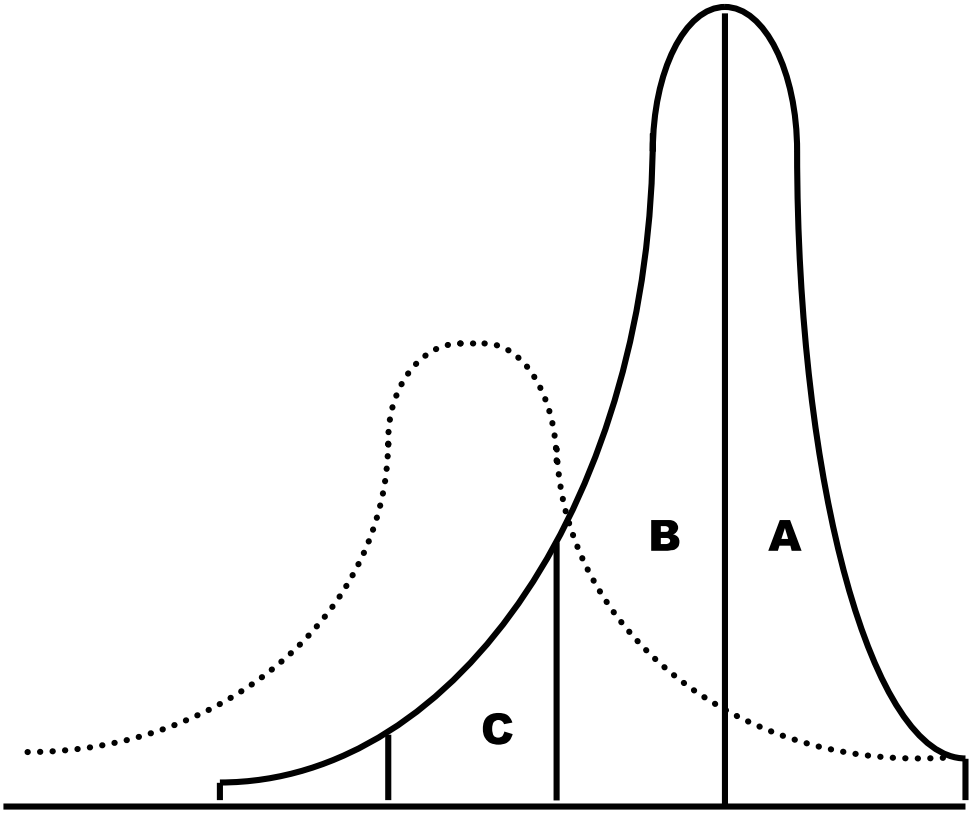

Figure 3. Distribution of Achievement in Mastery Learning Classrooms

In describing mastery learning, however, Bloom emphasized that reducing variation in students' achievement does not imply making all students the same. Even under these more favorable learning conditions, some students undoubtedly will learn more than others, especially those involved in enrichment activities. But by recognizing relevant, individual differences among students and then altering instruction to better meet their diverse learning needs, Bloom believed the variation among students in terms of how well they learn specific concepts or master a set of articulated learning goals could eventually reach a "vanishing point" (Bloom, 1973). As a result, gaps in the achievement of different groups of students would be closed.

Essential Elements of Mastery Learning

After Benjamin Bloom presented his ideas on mastery learning, others described procedures for implementation and numerous programs based on mastery learning principles sprung up in schools and colleges throughout the United States and around the world (e.g., Block, 1971, 1974; Block & Anderson, 1975). While these programs differed from setting to setting, those true to Bloom's ideas included two essential elements: (1) the *feedback, corrective, and enrichment process*; and (2) *instructional alignment* (Guskey, 1997).

Feedback, Correctives, and Enrichment

Teachers who use mastery learning provide students with frequent and specific *feedback* on their learning progress, typically through the use of regular, formative classroom assessments.

Furthermore, this feedback is both diagnostic and prescriptive. It reinforces precisely what students were expected to learn, identifies what was learned well, and describes what needs to be learned better. The National Council of Teachers of Mathematics emphasizes this same element in its latest iteration of standards for school mathematics. To overcome inequities in mathematics instruction, NCTM stresses the use of assessments that support learning and provide useful information to both teachers and students (NCTM, 2000).

Feedback alone, however, does little to help students improve their learning. Significant improvement requires the feedback be paired with *correctives*: activities that offer guidance and direction to students on how to remedy their learning problems. Because of students' individual differences, no single method of instruction works best for all. To help every student learn well, therefore, teachers must differentiate their instruction, both in their initial teaching and especially through corrective activities (Bloom, 1976). In other words, teachers must *increase* variation in their teaching in order to *decrease* variation in results.

To be optimally effective, correctives must be qualitatively different from the initial teaching. They must provide students who need it with an alternative approach and additional time to learn. The best correctives present concepts differently and involve students in learning differently than did the teacher's initial instruction. They incorporate different learning styles, learning modalities, or types of intelligence. Although developing effective correctives can prove challenging, many schools find that providing teachers with time to work collaboratively, sharing ideas, materials, and expertise, greatly facilitates the process (Guskey, 2001).

In most applications of mastery learning, correctives are accompanied by *enrichment* or *extension* activities for students who master the unit concepts from the initial teaching. As described above, enrichment activities offer students exciting opportunities to broaden and expand their learning. They reward students for their learning success but also challenge them to go further. Many teachers draw from activities developed for gifted and talented students when planning enrichment activities, both to simplify implementation tasks and to guarantee these students a high quality learning experience.

Teachers implement the feedback, corrective, and enrichment process in a variety of ways. Many use short, paper-and-pencil quizzes as formative assessments to give students feedback on their learning progress. But formative assessments can also take the form of essays, compositions, projects, reports, performance tasks, skill demonstrations, oral presentations, or any device used to gain evidence on students' learning progress.

Following a formative assessment, some teachers divide the class into separate corrective and enrichment groups. While the teacher directs corrective activities, guaranteeing that all students with learning difficulties take part, the other students work on self-selected, independent enrichment activities. Other teachers pair with colleagues and use a team-teaching approach. While one teacher oversees corrective activities the other monitors enrichments. Still other teachers use cooperative learning activities in which students work together in teams to ensure all reach the mastery level. If all attain mastery on the second formative assessment, the entire team receives special awards or credit.

Feedback, corrective, and enrichment procedures are crucial to mastery learning, for it is through these procedures that mastery learning differentiates and individualizes instruction. In every unit taught, students who need extended time and opportunity to remedy learning problems are offered these through correctives. Those students who learn quickly and for whom the initial instruction was highly appropriate are provided with opportunities to extend their learning

through enrichment. As a result, all students are provided with more favorable learning conditions and more appropriate, higher quality instruction (Bloom, 1977).

Instructional Alignment

While feedback, correctives, and enrichment are extremely important, they alone do not constitute mastery learning. To be truly effective, Bloom stressed they must be combined with the second essential element of mastery learning: *instructional alignment*. Reducing variation in student learning and closing achievement gaps requires clarity and consistency among all instructional components.

The teaching and learning process is generally perceived to have three major components. To begin there must be some idea about what we want students to learn and be able to do; that is, *learning goals or standards*. This is followed by *instruction* that, hopefully, results in *competent learners* – students who have learned well and whose competence can be assessed through some form of assessment or evaluation. Mastery learning adds the feedback and corrective component, allowing teachers to determine for whom their initial instruction was appropriate and for whom learning alternatives may be needed.

Although essentially neutral with regard to what is taught, how it is taught, and how learning is evaluated, mastery learning requires consistency or alignment among these instructional components, as shown in Figure 4. If, for example, students are expected to learn higher level skills such as those involved in making applications, problem solving, or analysis, mastery learning stipulates that instructional activities must be planned to give students opportunities to practice and actively engage in those skills. It also requires that students be given specific feedback on how well they have learned those skills, coupled with directions on how to correct any learning errors. Finally, procedures for evaluating students' learning should reflect those higher level skills as well.

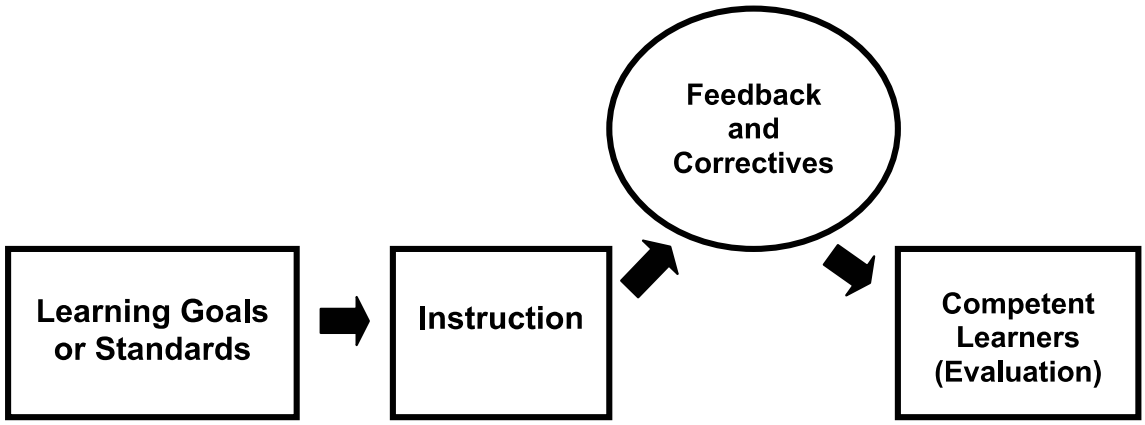

Figure 4. Major Components in the Teaching and Learning Process

Ensuring alignment among instructional components requires teachers to make several crucial decisions. They must decide, for example, what concepts or skills are most important for students to learn and most central to students' understanding. They also must decide what evidence best reflects students' mastery of those concepts or skills. But, in essence, teachers at all levels make these decisions already. Every time they administer an assessment, grade a

paper, or evaluate students' learning, teachers communicate to students what they consider to be most important. Using mastery learning simply compels teachers to make these decisions more thoughtfully and intentionally.

Misinterpretations of Mastery Learning

Some early attempts to implement mastery learning were based on narrow and inaccurate interpretations of Bloom's ideas. These programs focused on low-level cognitive skills, attempted to break learning down into small segments, and insisted students "master" each segment before being permitted to move on. Teachers were regarded in these programs as little more than managers of materials and record-keepers of student progress.

Nowhere in Bloom's writing can the suggestion of this kind of narrowness and rigidity be found. Bloom always considered thoughtful and reflective teachers vital to the successful implementation of mastery learning and continually stressed flexibility in its application. In his earliest description of the process he wrote:

> There are many alternative strategies for mastery learning. Each strategy must find some way of dealing with individual differences in learners through some means of relating instruction to the needs and characteristics of the learners. ... The alternative high school schedule … is one attempt to provide an organizational structure that permits and encourages mastery learning. (Bloom, 1968, pp. 7-8).

Bloom also emphasized the need for instruction and assessments in mastery learning classrooms to focus on higher level learning goals, not simply basic skills. He noted:

> I find great emphasis on problem solving, applications of principles, analytical skills, and creativity. Such higher mental processes are emphasized because this type of learning enables the individual to relate his or her learning to the many problems he or she encounters in day-to-day living. These abilities are stressed because they are retained and utilized long after the individual has forgotten the detailed specifics of the subject matter taught in the schools. These abilities are regarded as one set of essential characteristics needed to continue learning and to cope with a rapidly changing world. (Bloom, 1978, p. 578).

Modern research studies show mastery learning to be particularly effective when applied to instruction focusing on higher level learning goals such as problem solving, drawing inferences, deductive reasoning, and creative expression (Guskey, 1997). The process helps teachers close achievement gaps in a broad range of learning goals from basic knowledge and skills to highly complex cognitive processes.

In addition, some secondary teachers worry about the constraint of class time. With only limited time available, they fear the introduction of feedback, corrective, and enrichment procedures will reduce the amount of material they will be able to cover. As a result, they will have to sacrifice *coverage* for the sake of *mastery*.

The first few mastery learning units typically do require more time than usual. Students must be provided with some orientation to the process, and class time usually needs to be set aside for the teacher to direct students in their corrective work. Teachers who try to have correctives completed as homework or during a special study session before or after school find

that those students who most need the extra time are the least likely to take part. As a result, it's not unusual for a mastery learning class to be somewhat behind a more traditionally taught class during the first two or three units.

After students become familiar with the mastery learning process, however, most teachers find that they can pick up the pace of their instruction. Mastery learning students tend to be engaged in learning activities for a larger portion of the time they spend in class. Hence they learn more and learn faster in later units than do students in more traditionally taught classes (Arlin, 1973; Fitzpatrick, 1985). As students catch on to mastery learning, they also tend to do better on first formative assessments. With fewer students involved in correctives and a reduced amount of corrective work required, the class time allocated to correctives in later units can be drastically reduced. Furthermore, because mastery learning students learn well the concepts and skills from early units, they are better prepared for later, more advanced units. This means that less time needs to be spent in review activities. Thus most teachers find that with slight changes in the pacing of their instruction (slightly more time spent in early units but less time in later ones), they are able to cover just as much material, and in some cases more, as they were able to using more traditional approaches to instruction (Block, 1983; Guskey, 1983, 1987).

Research Results

Implementing mastery learning requires relatively modest changes in teachers' instructional procedures. In most cases it builds on the practices teachers have developed and refined over the years. Most excellent teachers probably use aspects of mastery learning already. Others typically find the process blends well with their present teaching strategies.

Despite the modest nature of these alterations, however, extensive research evidence shows the use of mastery learning can have exceptionally positive effects on student learning. An extensive, comprehensive review of the research on mastery learning concluded:

> We recently reviewed meta-analyses in nearly 40 different areas of educational research (J. Kulik & Kulik, 1989). Few educational treatments of any sort were consistently associated with achievement effects as large as those produced by mastery learning. ... In evaluation after evaluation, mastery programs have produced impressive gains. (Kulik, Kulik, & Bangert-Drowns, 1990, p. 292).

Providing feedback, correctives, and enrichments; and ensuring instructional alignment takes relatively little time and effort, especially if tasks are shared collaboratively among teaching colleagues. Still, results show that the systematic use of these elements helps many more students learn well, significantly reduces variation in student learning outcomes, and closes gaps in the achievement of different groups of students.

Equally important, the positive effects of mastery learning are evident not only in measures of student achievement. The process also has been shown to yield improvements in students' confidence in learning situations, school attendance rates, involvement in class lessons, attitudes toward learning, and a host of other affective measures (Guskey & Pigott, 1988). This multidimensional impact has been referred to as the "multiplier effect" of mastery learning, and makes it an especially powerful tool in school improvement efforts.

Conclusion

Numerous factors affect student learning, many lying beyond classroom walls and outside of teachers' control. A recent Educational Testing Service report, for example, identified a wide range of environmental factors that may contribute to achievement gaps, the majority of which are external to schools (Barton, 2003). Denying the role of these outside influences will not endow teachers and schools with the capacity to reduce achievement gaps, and efforts to address these home and community-based challenges must continue (Rothstein, 2004).

Nevertheless, the impediments to learning in students' environments outside of school should never become a basis for lowering expectations about what can be done to help them learn well in school. The feedback, correctives, and enrichment process, and instructional alignment elements of mastery learning represent powerful tools that teachers can use to capitalize on the influence they have. They are not, of course, the only factors of importance. In his later writing Bloom described exciting work on other ideas designed to attain results even more positive than those typically achieved with mastery learning (Bloom, 1984, 1988). Still, careful attention to these elements allows educators at all levels to make great strides in their efforts to reduce variation in student achievement and close achievement gaps. They offer the tools needed to help students of different racial, ethnic, and socioeconomic backgrounds all learn excellently, succeed in school, and gain the many positive benefits of that success.

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